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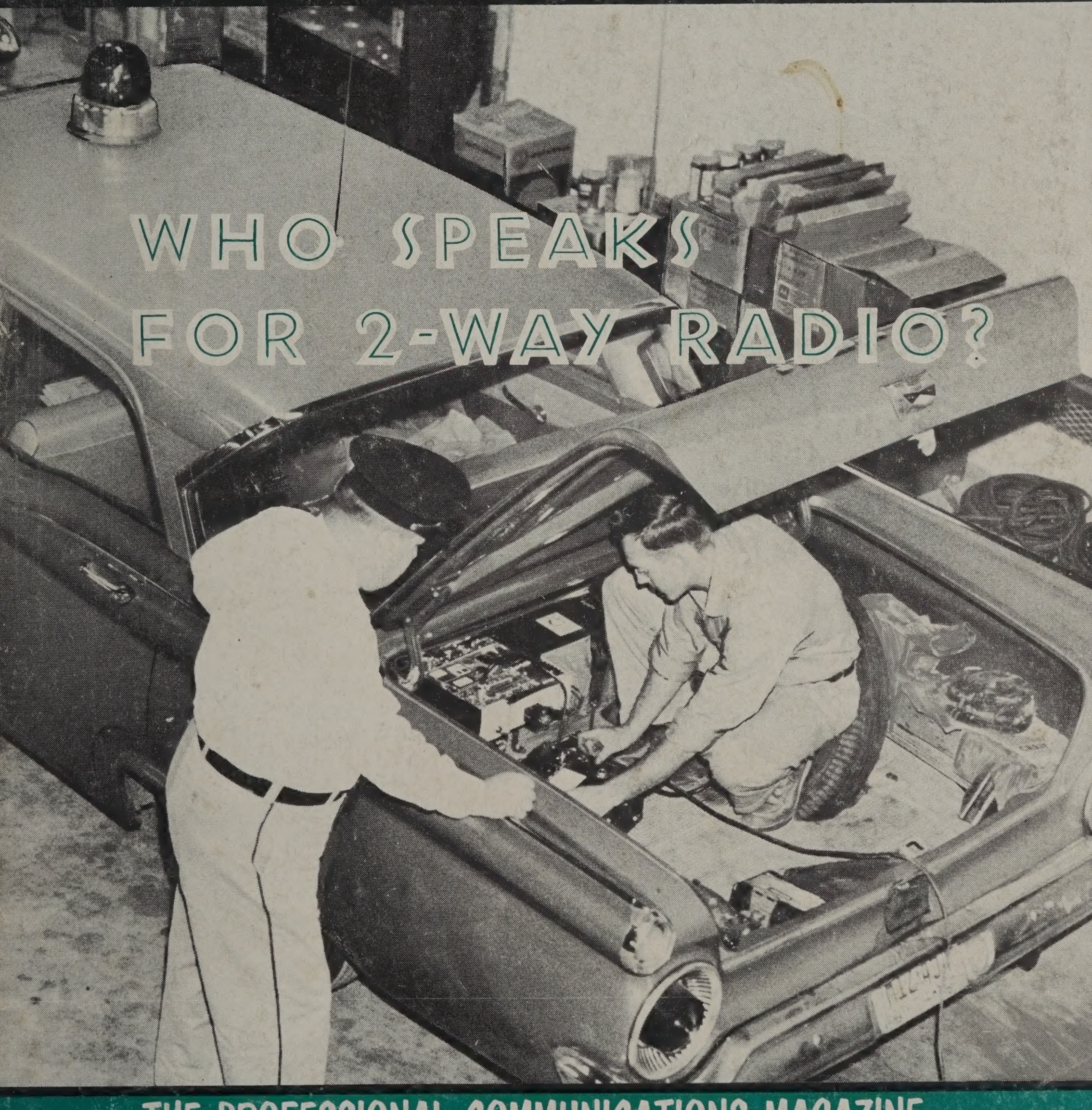

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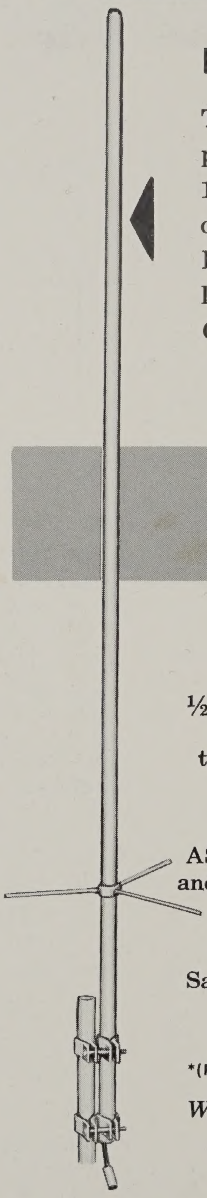

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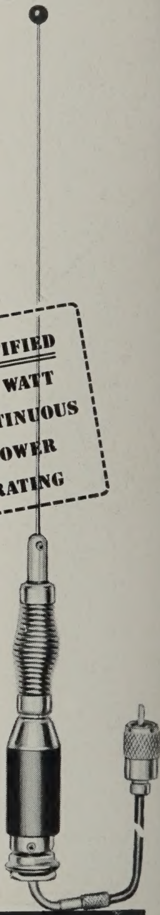

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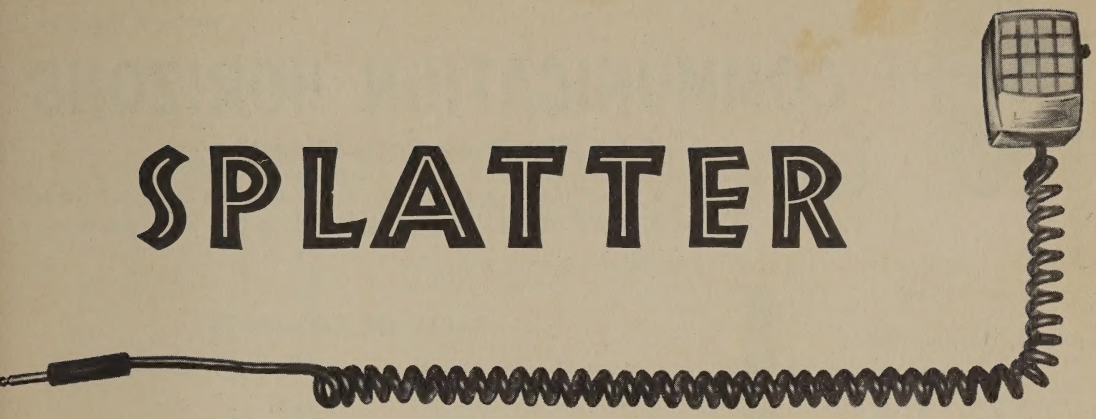

Editorial Notes from
Communication Horizons Editor
Robert B. Cooper, Jr., K6EDX

Sometime prior to press-time, Communication Horizons shared in a "press-leak." We were slipped an advance copy of a filing which *was going* to be made with the Federal Communications Commission, concerning the pending FCC docket 14229. We felt the proposed filing would be the hottest story in the communications field during all of 1961. The presses ground to a halt, urgent re-writing of copy was begun and a whole new admiration for the industry was developing among our staff.

The filing, you see, showed the industry standing on its own two feet, collectively, fighting for something the industry as a whole felt was *the right thing to do.*

Then on December 1 we got the word. *Kill the story!*

We were stunned. Not concerned with the copy already set . . not concerned with the work we had put into the story. All that was incidental, and I might add, part of the everday life of publishing.

We were stunned and still are stunned, because the industry as a whole had fallen apart at the seams at a time when it should have been pulling closest together. All of the petty power groups, which apparently had pulled together during the original writing and re-writing of this petition, had fallen apart when the final decision was to be made.

Don't get us wrong. The Communications world won't lie down and die with this defeat from within. It can't, because it is too filled with real-honest-to-goodness believers to allow this to happen.

At press-time we have assurance the petition may still be filed, but in another form. And while the text and message of the filing may remain substantially unchanged from the original, the affect of the filing will be lessened considerably because it has lost the support of the body as a whole.

You will recognize the petition when it is filed. It will be obvious because of its importance. It deals with allocations . . the life blood of our entire industry, not just the lifeblood of a particular segment or a particular company.

You will recognize the petition because it speaks of broadening the scope of Docket 14229, to include land-mobile communications as well as that commercial monster, VHF television.

And you may even recognize the reason it was not filed by the industry representative group, by the very line-up of those who do file it and back it.

For let the chips fall where they may . . the real friends of the industry, those who place the land-mobile communications on a par *even* with television, will rush to stand behind it. Those who remain silent, and those who oppose, will clearly align themselves with the broadcasting interests.

R.B.C.

JANUARY, 1962
Volume 2 • Number 1

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and "Two-Way Radio Digest"

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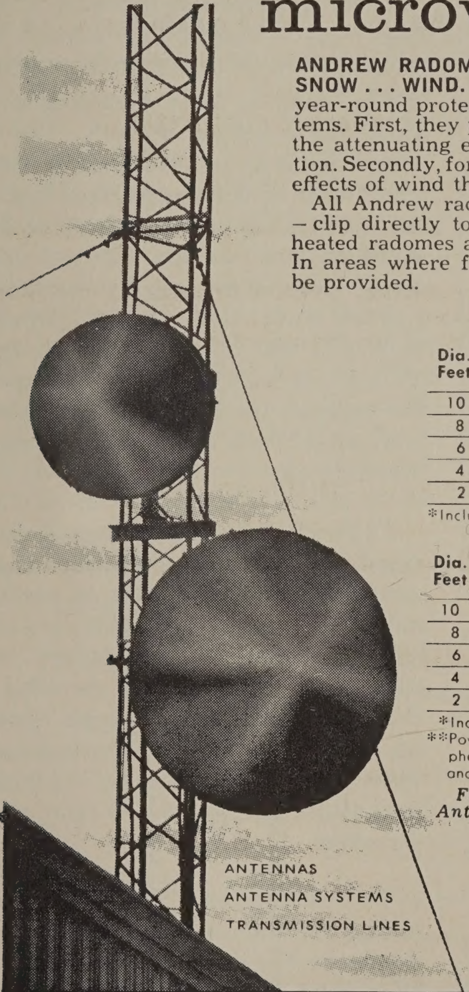

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SPECIFICATIONS

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Dia. Feet	Type No.	Attenuation @ 6 kmc. db	VSWR Contribution @ 6 kmc.	Thrust at* 30 psf (Flats), lbs.
10	R10	0.4	0.02	1,990
8	R8	0.4	0.02	1,270
6	R6	0.4	0.02	714
4	R4	0.4	0.02	320
2	R2	0.4	0.02	75

*Including antenna

HEATED RADOMES

Dia. Feet	Type No.	Atten. @ 6 kmc. db	VSWR Contr. @ 6 kmc.	Thrust at* 30 psf (Flats), lbs.	Power** Reqmts.
10	HR10	0.7	0.02	1,990	3,400 W.
8	HR8	0.7	0.02	1,270	2,400 W.
6	HR6	0.7	0.02	714	1,200 W.
4	HR4	0.7	0.02	320	550 W.
2	HR2	0.7	0.02	75	150 W.

*Including antenna

**Power requirements for HR10 and HR8 are 3 wire single phase 60 cycle 220 volts. Power requirements for HR6, HR4 and HR2 are single phase 60 cycle 115 volts

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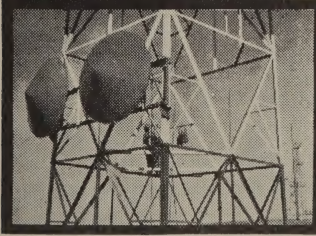
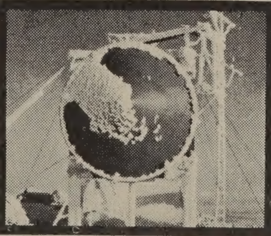
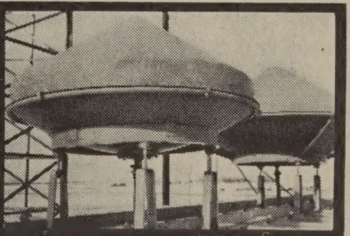


"Very obvious that these radomes quite materially reduce the wind loading on the parabolas—due to their shape factor." *Washington State Patrol, Kennewick, Wash.*



"Up to 4 inches of ice on radome with practically no reduction of antenna effectiveness." *The KLIX Corporation, Twin Falls, Idaho.*



"Our field forces report that the radomes produce a signal loss of less than 1 db per antenna." *Natural Gas Pipeline Company of America.*

STATIC FREE ANTENNAS IN THE 30 TO 50 MC/S REGION

By
Ned A. Spencer, Wheeler Labs, Inc.
Great Neck, Long Island, New York

Editor's Note: This paper was originally presented at the PGVC 10th National Conference at St. Petersburg, Florida.

The subject of the paper is "antenna design" and noise static caused by precipitation, whether rain or snow (although rain is almost always the culprit). Precipitation static can be exceedingly annoying in this frequency range, and any antenna design capable of reducing this noise is certainly worthy of consideration.

R. B. Cooper, Jr.

History Of Noise Study.

One of the earliest written articles on precipitation static in a base-station antenna was by Nakai in 1937 (Ref. 1). In 1939, Hucke (Ref. 2) conducted an extensive series of tests on precipitation static in aircraft. In 1946, with the aircraft problem increasing in severity, Gunn and his group (Ref. 3) launched an all out offensive against precipitation static in aircraft. This resulted in the now-famous wick dischargers seen on most aircraft today. In the PGVC Convention Meeting of 1956, Scheldorf reported the results of a survey of static in base-station antennas (Ref. 4). These results indicated that approximately 25 percent of the causes of static were so-called natural causes. Of these, approximately 50 percent were caused by charged particles impinging on the antenna, and 12 percent by corona; the remainder was by atmospherics (lightning).

Design Of The Antenna.

The basic antenna made use of in this investigation is one of the most common types found in VHF base-station installations and is shown in Fig. 1. The whip of this antenna is an extension of the center conductor of the coaxial feed line and the skirt is a folded back extension of the outer conductor of this line. The antenna is isolated from the mast by means of the quarter-wave trap formed between the skirt and the outer surface of the mast. When properly tuned, the trap isolates the antenna from the mast and insures the operation of the antenna as a vertical half-wave dipole.

Experience from field installations indicated that this and other standard types of antennas were susceptible to precipitation static and corona. Different types of antennas sometimes gave temporary improvement, but none seemed directed against the basic problem. The noise appeared to be caused by charged particles of rain, snow, or dust hitting the radiating elements, and also by corona from the top of the whip.

To prevent the charged particles from hitting the antenna and to quiet the corona discharge, the design in Fig. 2 was evolved (See page 2). This antenna is essentially an enclosed half-wave radiating sleeve surrounding a mast. The top of the mast provides lightning protection and means for controlling the corona discharge level. A current limiting resistor near the top insures that the discharge will be gradual, thereby reducing the noise from this source. A dielectric sheath surrounds the radiating conductor of the antenna and insulates it from the charged particles. As before, the trap isolates the radiating part of the antenna from the mast.

Coupling to the antenna is obtained by means of a tap within a resonant transformer in the upper half of the radiating sleeve. The tap is so located as to provide the correct impedance level to the coaxial feed line.

Noise From Charged Particles.

In order to obtain some insight into the cause of the noise, a number of tests were made in the laboratory. An arrangement for making one of these tests is shown schematically in Fig. 3 (See Page 2). In this test, a high-voltage DC power supply is connected to a reservoir of water. Charged drops of water are then permitted to fall on the center conductor of a Hewlett Packard slab line. One end of the line is match terminated, the other is fed to a 30Mc tuned amplifier and from there to an indicator. The Hewlett Packard line provides an accessible conductor in a controlled environment, being shielded from external fields. The construction of the line is excellent for this test, as the drops can fall directly onto the center conductor and then drip away.

Making use of this test technique two specific effects were noted. First, there was a definite threshold value of voltage on the drop, below which no noise was observed. Second, when the test equipment was altered to make a standing wave appear on the line, noise was found to be proportional to the electric field intensity at the place where the drop impinged on the conductor. These and other observations led to the conclusion that the cause of noise is a spark discharge from the charged particle to the conductor just prior to contact.

Measurements made using the test apparatus outlined above indicate that a drop voltage of approximately 100 volts is necessary to produce this sparking condition. Since field tests have indicated considerable trouble from precipitation static it seems evident that voltages in excess of this threshold value are present in nature.

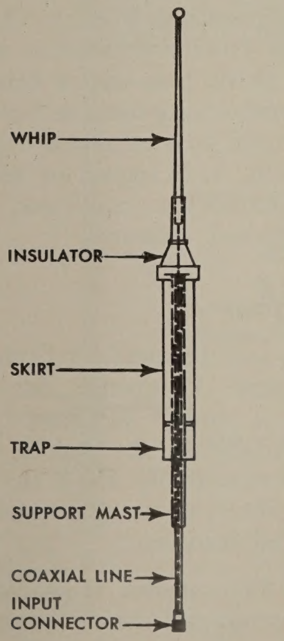


FIG. 1 SKETCH OF SIMPLE COAXIAL ANTENNA

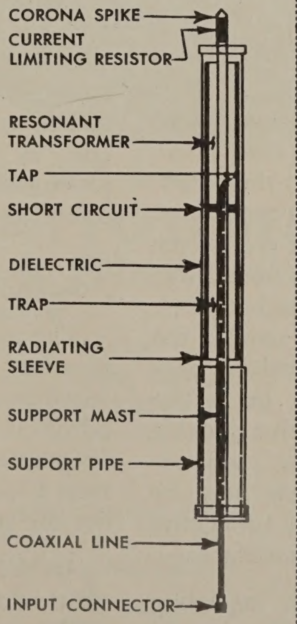


FIG. 2 SKETCH OF ANTENNA WITH DIELECTRIC SHEATH

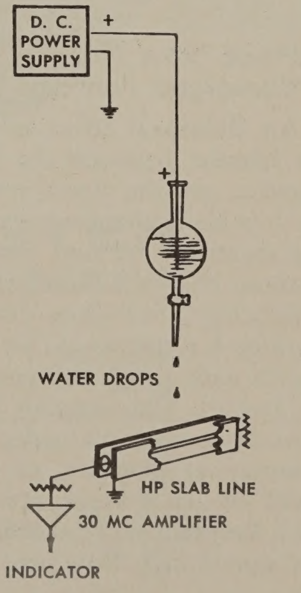


FIG. 3 EXPERIMENTAL ASSEMBLY TO SIMULATE PRECIPITATION STATIC

Having determined the lower limit of noise producing voltage it was then desirable to specify as closely as possible an upper voltage limit. This upper limit is established by corona discharge from an isolated drop. This maximum voltage is estimated to be approximately 10 KV, for typical drop sizes.

It appears, then, that insulating the antenna conductor adequately for this maximum voltage will preclude the spark discharge and eliminate noise from this source. This is true, however it does not eliminate all the precipitation noise.

It was found that a spark would occur between two charged drops arriving in succession, so that one contacts the dielectric sheath and redistributes the charge before the other strikes it. Fortunately, this noise is considerably lower than that caused by a direct discharge to the antenna by a factor of 20 to 30 db.

A second form of particle is the non-conductive dielectric particle. If charged, it behaves similarly to the conducting particle, except for a lesser effect.

Noise From Non-Conductive Uncharged Particles

An additional effect may be produced by friction between the non-conductive particles and the sheath around the antenna. It is likely that the particles can charge the sheath by friction. Should the sheath become charged, there are various noise producing possibilities for discharge. A remedy for this would be to provide the sheath with a high-resistance leakage path to ground. This coating may be in the form of epoxy resin loaded with a suitable quantity of graphite, or some commercially available resistance paint may be used. Resistances in the order of 1 megohm per square inch have proved satisfactory.

The net result in using an insulating sheath as described above is that, if it is properly applied there will be a great reduction in noise from impinging particles.

Noise From Corona

The most effective means of reducing corona noise is to place the discharge point beyond the field of the antenna. This technique forms the basis of aircraft practices and would be most effective for base-station antennas. It would require, however, that this type of antenna have a conductor extending approximately one-half wavelength above the radiator. Consequently another method was chosen for this design.

A considerable reduction in corona noise is possible if the discharge is permitted to occur in a gradual manner. This technique, too, is applied in aircraft practices where corona noise is severe. The method used to obtain a gradual discharge is to make it occur at a point where a low gradient will start a small discharge. A high series resistance keeps the discharge at this low level reducing the noise and also reducing the errosion of the point.

Conclusion.

Laboratory tests have been conducted which indicate a possible 20 to 30 db reduction in noise from precipitation static and corona. A 30 Mc base-station antenna has been built embodying these techniques and more than one year of actual experience in the field, in a region of severe precipitation static, has confirmed the effectiveness of these measures.

Acknowledgments.

This antenna was designed for Communication Products Company, Inc. of Marlboro, N. J., and is designated the STORM CHAMPION. In making this design, we worked with Mr. W. B. Bryson, their Chief Engineer, who was responsible for the structural features.

At Wheeler Laboratories, the development of the antenna and the development of the special tests were conducted by D. F. Hastings, W. E. Meserole, and the author, under the direction of H. A. Wheeler.

—with Cat. No. 200-509

STATIONMASTER
Base Station Antenna

Specifications

FREQUENCY RANGE	144-174 Mc
OMNIDIRECTIONAL GAIN	5.8 db
MAXIMUM POWER INPUT	500 watts
NOMINAL INPUT IMPEDANCE	50 ohms
BANDWIDTH	± 0.3%
VSWR	1.5:1
RATED WIND VELOCITY	100 MPH
WEIGHT	30 lbs.
ELEMENT HOUSING LENGTH	19′

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MULTI TRANSMITTER-RECEIVER INSTALLATION INTERFERENCE

PROBLEMS AND CURES

STUART F. MEYER
The Hammarlund Mfg. Co.
New York, New York

Part Two

EDITOR'S NOTE: Part one of this SY-PEP paper appeared in the December issue of Communication Horizons. The introductory paragraphs discussed the various forms of overload interference prevalent in areas where more than a single VHF-UHF transmitter has been installed. This second and concluding portion concerns specific overload interference problems, their causes and cures.

In stubborn cases of interference it may be necessary to use cavity resonators in the output circuits of the transmitters, in order to attenuate the undesired signals.

These cavities should be installed in the transmission line of each transmitter involved, although a single cavity often will cure the problem if placed in the proper antenna lead. The use of a single cavity, eliminating the spurious signal, allows the other or others to be generated. Sometimes an improvement can be achieved by reducing the grid drive to the final stage or stages somewhat beyond that required for power output saturation, thereby reducing distortion products. However this technique will provide only improvements in the order of several db which may be used in some instances to put the finishing touches on a clean up program. It is therefore highly recommended that when frequencies are selected for multiple base station sites, exact multiples between various channels be avoided in an attempt to minimize or eliminate this type of problem. One of the confusing things is that the transmitter-caused intermodulation and receiver-caused intermodulation sound very much the same at the receiver end of the system and appropriate steps must be taken to determine *where* the interference is taking place. Since the fundamental problems are the same, it is quite likely that in some instances both are present and each will, therefore, have to be located and cured.

The most common fundamental problem concerning receiver spurious signals is image response, either direct as a result of the first conversion process, or indirect resulting from the second conversion stage. The direct image is usually sufficiently removed from the carrier or input frequency that a rejection stub constructed of inexpensive RG58/U transmission line may be useful. In some cases it may be possible to add what is known as an image trap. This consists of a parallel tuned circuit tuned to the image frequency and loosely coupled to one of the input stages of the receiver, most preferably the first stage. Simple image traps consisting of a parallel tuned circuit are capable of attenuation in excess of 20 db and typical image trap circuitry is shown in Figure 2. The alignment procedure when using one of these traps is to first align the receiver in its normal fashion then retune the signal generator to the image frequency and carefully adjust the trap for maximum suckout. It will be found that as the image trap approaches resonance it will be necessary to increase the output of the signal generator so the adjustment can be finalized.

The indirect image presents more of a cure-problem because it is closer (precentage-wise) to the carrier frequency. A brute force cure uses a cavity resonator;

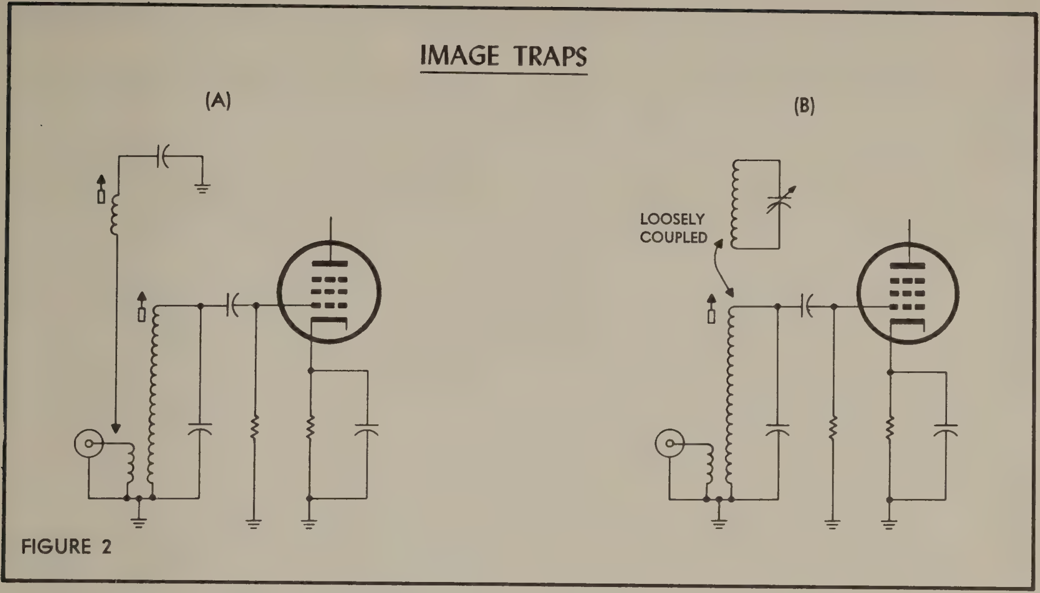


FIGURE 2

however, this technique is relatively expensive. Very often the receiver manufacturer may be able to offer some help, particularly along the lines of alternate injection frequencies, obtainable by substitution of the second i.f. crystal. Many equipment suppliers stock these alternate i.f. crystals for this purpose, however, the possibility is always present that the condition may show itself on the new spurious frequency at some future date when additional equipment is placed in service. Another receiver type of spurious response is created by harmonics of the i.f. frequency in the 1st or 2nd mixer circuitry, particularly the 2nd mixers in receivers using low frequency channel filtering. This problem exists partly because of insufficient selectivity in the high i.f. stages of a double conversion receiver with the end result that the set is responsive to an input signal which is equal to the desired signal frequency plus or minus half of the final i.f. frequency. This problem is shown in detail in Figure 3. With final i.f. frequencies in the vicinity of 200 to 500 kc., it is easy to see that this unwanted response can be quite a problem, even though the receiver meets its advertised attenuation specification in the vicinity of 85 to 100 db. Quite often it is necessary to resort to a cavity resonator as rarely will modification of the receiver circuitry produce sufficient improvement to completely clean up the problem. At one time it was possible to retune the i.f. stages and offset the 1st or 2nd conversion crystals by an equal amount; however the trend to sealed filters now rules this out as a possibility. Receiver designs incorporating high frequency (1st i.f.) channel filtering are less susceptible to this type of interference because off channel signals are not amplified to the same extent prior to the 2nd convertor stage. A typical example of a design meeting this requirement is that employed in the Hammarlund type FM50-A communications unit which incorporates a 10.7 mc. crystal filter in the plate circuit of the 1st mixer and adjacent and alternate channel signals are not amplified beyond this point. A block diagram showing this technique is illustrated in Figure 4. Other spurious responses may arise from unwanted harmonics of the first and/or second oscillators. As a general rule shielding or circuit isolation between the input and the second oscillator is a definite help, although in many instances (particularly low band equipment) the separation frequency between the i.f. crystal and the input frequency is so small that it may be necessary to resort to alternate side injection to dodge a particular problem. By the same token a relatively low order of multiplication made possible by the use of overtone crystals in the first oscillator circuitry

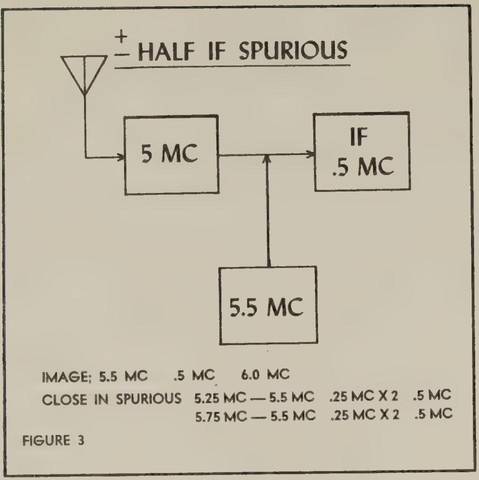

± HALF IF SPURIOUS
5 MC
IF
.5 MC
5.5 MC
IMAGE: 5.5 MC .5 MC 6.0 MC
CLOSE IN SPURIOUS 5.25 MC — 5.5 MC .25 MC X 2 .5 MC
5.75 MC — 5.5 MC .25 MC X 2 .5 MC

FIGURE 3

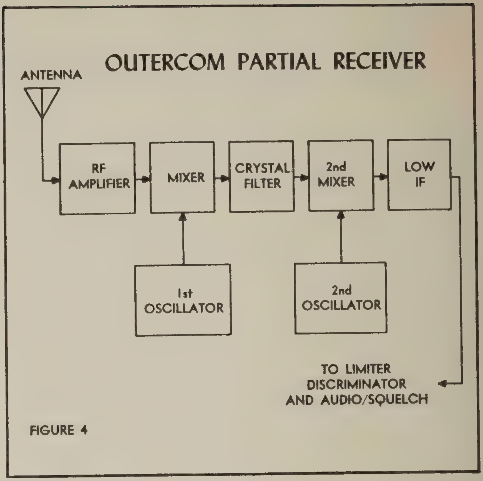


FIGURE 4

will reduce the total number of spurious responses as compared to a receiver using a fundamental mode crystal with a relatively high order of multiplication. Often it is possible to convert from a fundamental mode crystal to a third mode crystal reducing the multiplication and thereby completely eliminating the problem, however, (except in very old receivers) it is well worthwhile to consult the manufacturer before proceeding with any changes.

Intermodulation and/or desensitization generated with a receiver is usually caused by common design problems. Desensitization is the characteristic that results in loss of on channel receiver sensitivity in the presence of strong off channel signal. In most instances the signal that is

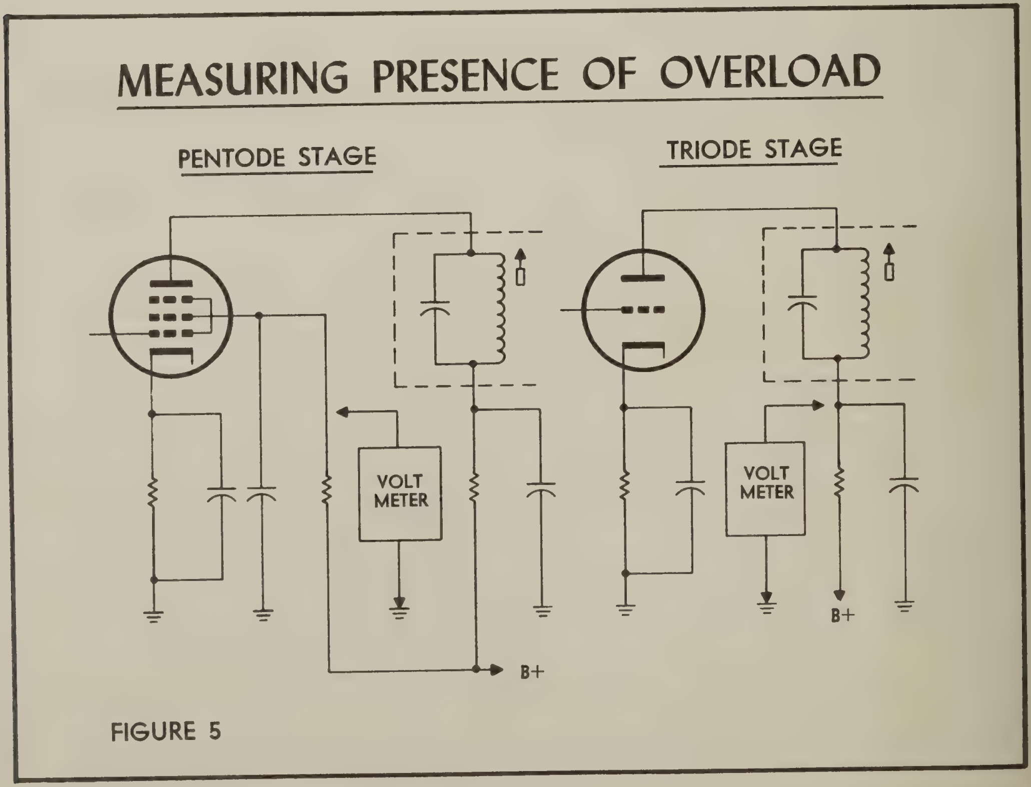
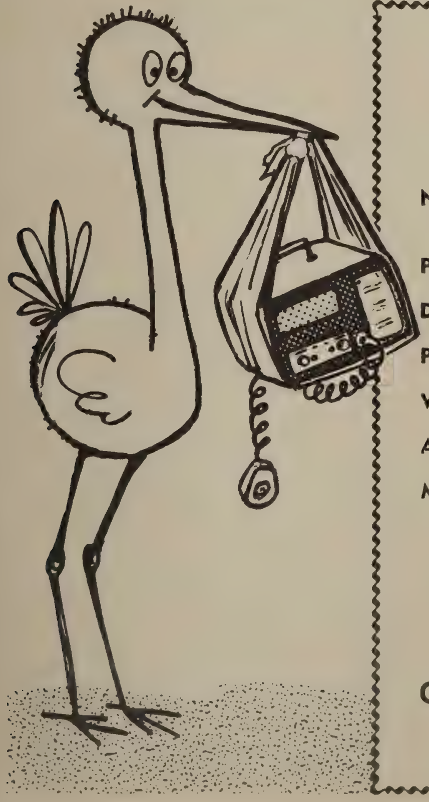


FIGURE 5

causing the desensitization will not get by the final i.f. filtering, or in multiple conversion receiver designs using low frequency filtering, the interfering signal may be amplified sufficiently to paralyze or desensitize one of the stages. The worst offender is the 2nd mixer, and a simple test is to measure the plate and/or screen voltage of the various stages along the line to see if a change takes place when the interfering transmitter is put on the air. See Figure 5. If the interfering frequency of the transmitter is several percent removed, the chances are that a stub on the input terminal of the receiver can be used. Also the trap technique shown in Figure 2 may be used. In more stubborn cases, particularly in low band where the interfering transmitter may well be in the order of 100 kc. removed, it may be possible to use a third mode overtone crystal in its series resonant operation-wired directly across the 1st or 2nd tuned circuit of the input section of the receiver so as to act as a short circuit to this frequency. This technique is shown in Figure 6. Channel frequencies removed by as little as 120 kc. in the low band may be attenuated at least 20 db with this method. A simple test to determine the number of db of improvement required is to arrange a system test consisting of a signal generator feeding an antenna. The generator is tuned to the input frequency of the receiver under test and a modulated signal is radiated with the generator attenuator set to produce a readable signal. A microvolt reading is taken for reference. If 200 microvolts are required with the interfering transmitter off, and 2000 microvolts are required to produce the same readable signal with the interfering transmitter on, then 20 db of attenuation of the undersired signal in the receiver is required. There are several areas of corrective measures open as referenced above; that is, series mode resonant crystals, better isolation of the antennas, etc. Often substitution of the troublesome receiver with one employing high frequency channel filtering will provide from 10 to 15 db of additional improvement.



Birth Announcement

NAME: FM-60A (First) "Low Band" (Middle) Outercom (Last)

PARENTS: By Hammarlund

DATE OF BIRTH: January 1, 1962

PLACE OF BIRTH: Mars Hill, N.C.

WEIGHT: 21 Pounds

ATTENDING PHYSICIAN: Dr. Stuart Meyer

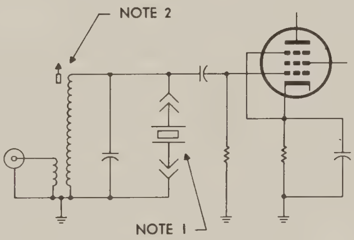
MEDICAL REPORT: Excellent. **Pulse:** 27 to 54 mcs. **Blood pressure:** 50 watts output. **Electrocardiograph:** Chart indicates will operate on 6 volts or 12 volts DC, and 117 volts AC. **Physical profile:** Exact similarity in physical appearance to older brother, FM50-A. Mother very weak—needs large quantities of orders. Donors are requested. Send all orders to:

OUTERCOM ELECTRONICS CORPORATION

502 Charlottetown Mall, Charlotte 4, N.C.

Base and mobile receivers are quite often one and the same design, that is, the same base unit is used for both base and mobile applications and may even be interchangeable. Since the mobile usage requires a unit that will work under extreme wide ranges of ambient temperature, humidity, voltage, etc., the design tend to favor this environment. A typical example is the case of a receiver that has 6 db of reserve gain in the r.f. stage and possible 10 db of reserve gain in the high i.f. stage. Reducing the gain of these stages for base station use by approximately that amount will improve the immunity of the receiver to both desensitization and intermodulation by a similar amount of db, and in some cases a greater amount. This can very often be achieved by lowering screen voltages on the associated stages or by the use of looser coupling between the tuned circuits. If this latter technique is at all practical it is the recommended technique as the use of incorrect tube operating potentials aggravate the problem. As a general rule increase of the cathode bias of the IF stage and decrease of the screen voltage of the r.f. stage. This will usually show reasonable magnitudes of improvement. On the other hand too low a screen voltage may cause the tube to block at a relatively low input of signal level, and coupled with loss of bias (due to less cathode current) may cause further problems. Once again a careful look at the situation is called for. In most instances manufacturers should be consulted before going too far, although there is nothing basically wrong with the "hunt and peck" method of trying to find a gimmick that will work, provided the equipment is not destructed in the process. Another technique worthy of consideration is anti-desensitization ciruitry which produces an additional cathode bias on an early stage of the receiver being interfered with, when the interfering transmitter is keyed. Under these circumstances it is possible to maintain maximum sensitivity under the condition where no interfering transmitter is on the air, and some happy compromise value of usable sensitivity with the transmitter on the air. This circuitry technique is shown in Figure 7. This system works best where remote cut-off tubes of the 6BZ6 type are employed. Receiver desensitization and intermodulation products which result from overload taking place in the second converter portions of the receiver are also prevalent, and as suggested earlier, designs employing high frequency filtering to obtain the desired channel bandwidth are less prone to this type of problem.

THIRD MODE REJECTION CRYSTAL (30 to 50 MC)



NOTE 1: 3rd MODE CRYSTAL SERIES RESONANT AT FREQUENCY TO BE ATTENUATED.

NOTE 2: AFTER INSTALLATION OF CRYSTAL THIS CIRCUIT SHOULD BE PEAKED FOR MAXIMUM SENSITIVITY TO ON CHANNEL SIGNAL.

FIGURE 6

Another area worth of mention for better understanding of the problems involved is that of simplex vs. duplex frequency assignments. A typical example is in the case of the taxicab radio service in the 150 mc. band with the base and mobile frequencies separated approximately 5 mc. If several taxi transmitters are operated from the same site it can be appreciated that all receiver frequencies will be removed from the interfering frequencies by 5 mc. With this relatively large spacing it is possible to use the simple stubs or traps to greater advantage than in the case of business radio where mobile and base station frequencies are relatively close. Of course the problem of intermodulation due to multiple channel equally spaced assignments must be avoided. As a general rule multiple base station operation of simplex frequency assignments in the same class of service are not very practical, unless costly techniques are used.

BASIC ANTI DESENSITIZATION CIRCUITRY

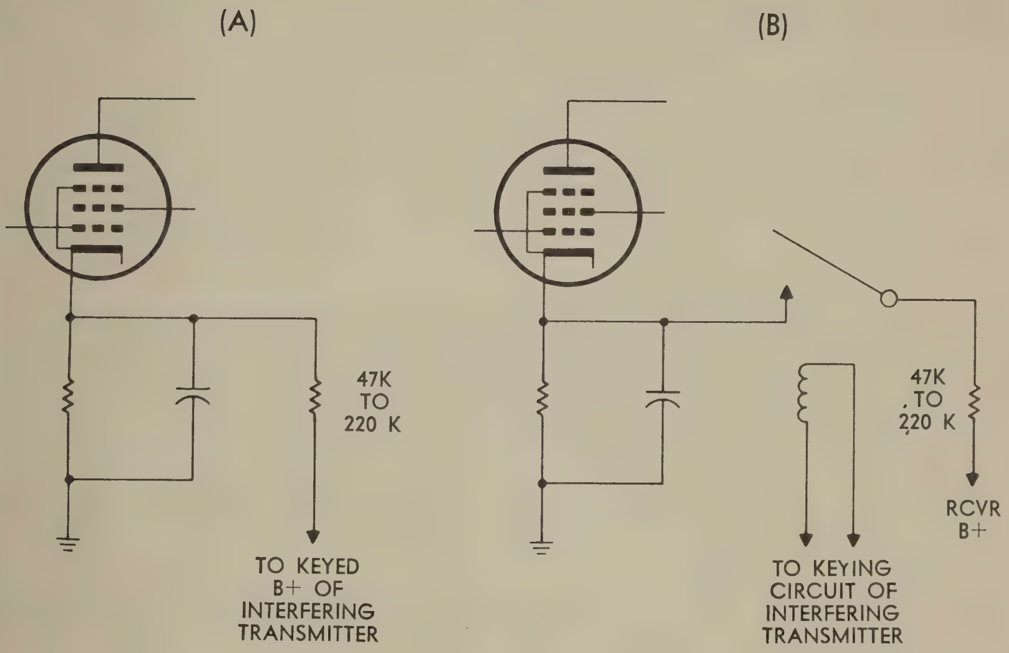


FIGURE 7

It is hoped that this paper has paved the way to some useful thinking along the lines of successful multiple base station installation. Although most of the information presented may lead one to believe at first hand that such base station sites are not a practical tool for the industry, due consideration of the problems and careful planning has resulted in many usable sites, particularly when judicious use of low, high and UHF assignments are integrated and some thought is given to the problems that are likely to be encountered. Of course we are dealing with a situation where experience from past association is a wonderful teacher. However, proper understanding of the problems and the various areas of approach should make it possible for the man in the field to better explain his situation to the manufacturer when asking for help, and in time help himself to solve many of his own problems which are sure to recur.

S.M.

TWO SY-PEP PAPERS IN THIS ISSUE . . .

Have You Submitted One Yet?

service notes
FROM AEROTRON

If your'e a technician servicing Aerotron two-way communications equipment and have run across a timely bit of advice for other Aerotron servicemen, send a brief write-up about it to Aerotron, Departmen C-H, Post Office Box 6527, Raleigh, North Carolina. If your suggestion is used in this column, we'll send you $10.00.

Our Service Notes column this month is devoted to the announcement of a new i-f alignment oscillator which is now being manufactured by Aeronautical Electronics, Inc.

The Aerotron TS-100 test set is a two-transistor crystal-controlled alignment oscillator with isolating emitter-follower amplifier. The complete unit is contained in a neat rounded-corner aluminum case, complete with a long-lasting nine-volt battery.

Output coupling is provided through a variable attenuator and BNC coaxial fitting. The tube-shield coupler supplied provides a means of injecting signal to the various receiver stages in the Aerotron line of receivers.

Three crystals are supplied at 10.7000, 10.7075, and 10.7150 Mc as required for alignment of various types of Aerotron two-way radio equipment. A fourth (vacant) crystal position is provided for any other crystal-controlled frequency in the 3- to 15-Mc range which the user may desire.

The TS-100 comes with three crystals, battery and tube-shield coupler.

Price available on request.

AEROTRON
Dept. C-H, Post Office Box 6527
Raleigh, North Carolina

LOGBOOK

A calendar of important meetings and events in the field of communications.

As still another service to our readers, COMMUNICATION HORIZONS is providing in this issue, a continuing "DATE-LINE" box to give at a glance, the scheduling of upcoming events of significance to the two-way radio field. We know we're falling short of the mark in our second attempt, since many organizations have not yet formally reported the dates of their 1962 annual meetings. As the dates become known, however, we would like to know them. CH Washington Chief Robert E. Tall will be handling this department, so just shoot him a note — at 1327 F St., N. W., Washington 4, D.C. — If we've neglected an already-established date in our second listing, or as your firm a time-table for a future event.

JANUARY

January 3, 1962 — Comments due on FCC proposal to allocate 46.52, 46.54, 46.56, and 46.58 mc. (former scatter frequencies) to local government radio service.

FEBRUARY

February 2, 1962 — Comments due on general FCC proceeding involving overall policy and technical proposals to aid UHF TV expansion.

February 15, 1962 — Study Committee of Institute of Radio Engineers and American Institute of Electrical Engineers to submit report on "the feasibility, practicability and form" of possible consolidation of the two organizations.

JUNE

June 3-5, 1962 — Semi-annual meeting of American Petroleum Institute's Central Committee on Communication Facilities and annual meeting of National Petroleum Radio Frequency Coordinating Association. Statler Hotel. Washington, D.C.

AUGUST

August 7-10, 1962 — National Conference of Associated Public-Safety Communication Officers. Harrison Hotel. Clearwater, Fla.

NOVEMBER

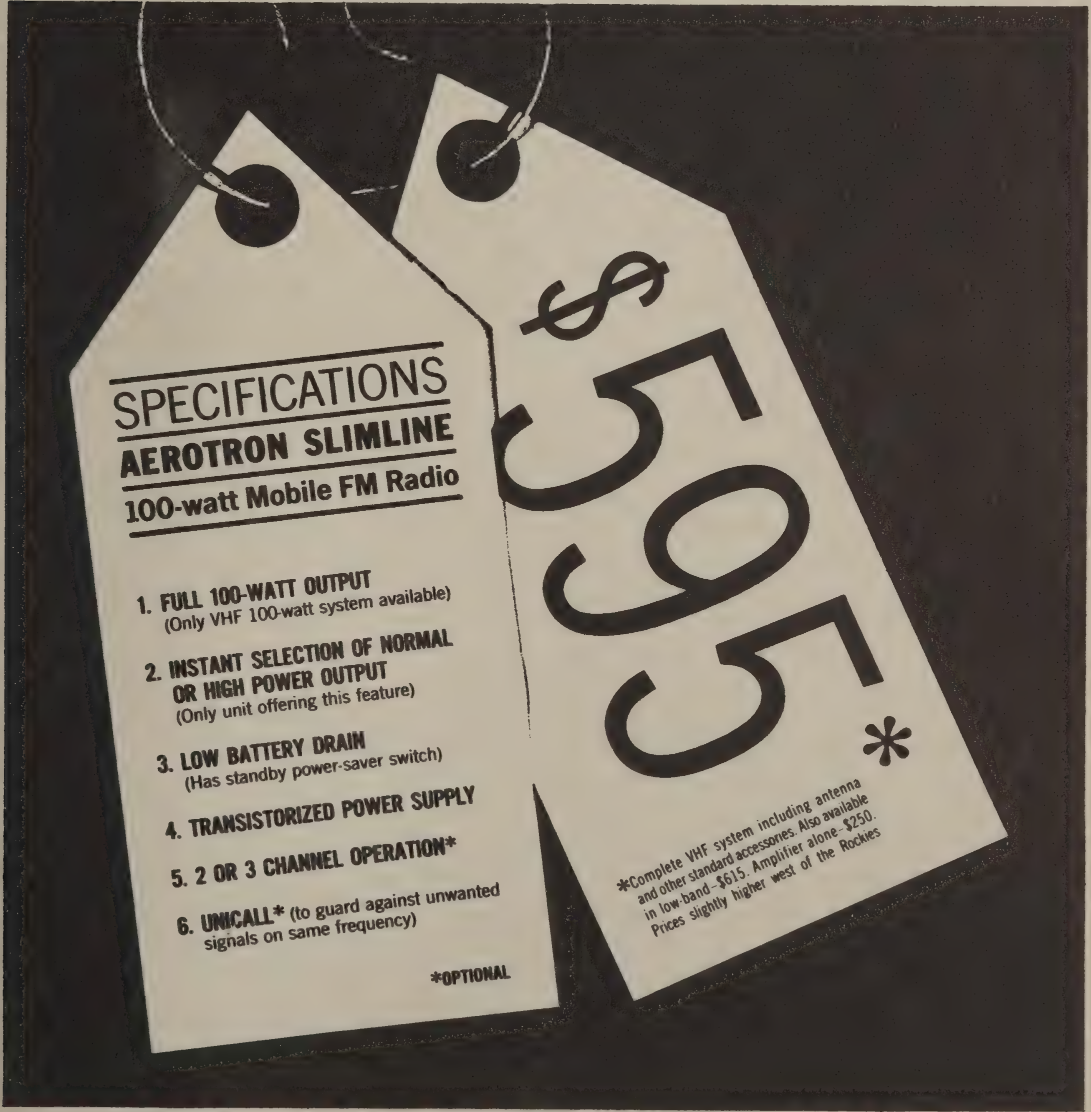
November 1, 1963 — FCC narrow-band standards for land mobile radio services become fully effective.

MORE POWER: For greater range, full saturation coverage. PRICE: Lower than the price of lower-powered equipment. No other system has as much power, more features, or more sensible optionals. NOTE: If you have mobile FM radio in the 10-30-watt category, the 100-watt amplifier alone will boost your power to full 100-watts. For free descriptive literature, write today: Aeronautical Electronics, Inc., P.O. Box 6527, Raleigh, North Carolina.

AEROTRON

(VHF: 148-174 MC)

A TALE OF TWO TICKETS



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3. **LOW BATTERY DRAIN** (Has standby power-saver switch)
4. **TRANSISTORIZED POWER SUPPLY**
5. **2 OR 3 CHANNEL OPERATION***
6. **UNICALL*** (to guard against unwanted signals on same frequency)

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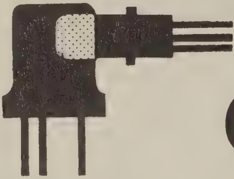
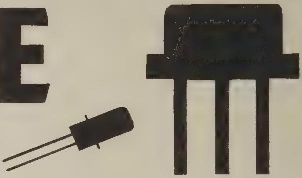
SOLID STATE COMMUNICATIONS





Donald L. Stoner
D. L. Stoner Associates
Alta Loma, California

As communications equipment is refined and specifications tightened, more and more stages are required. One example is the noise suppression circuits currently being added to narrow bandwidth receivers. Each time a tube is added to a piece of equipment, it results in an additional five watts of power consumption which must be supplied by the mobile electrical system. Thus it seems logical to assume that the current trend to solid state communications equipment will gain momentum. From the correspondence received by this writer, it appears that this type of thinking is common within the industry.

One occasionally hears the comment that transistors are noisy and temperature sensitive. However this is generally the result of misinformation and is no longer true of present day transistors. Many of the new devices are superior to vacuum tubes, with respect to noise figure and their cost is surprisingly low. While it is true that transistor characteristics vary with temperature, the effects of this can be minimized by proper circuitry design. Generally speaking, modern solid state equipment which fails to function above say 120°C is improperly designed. It may be satisfactory for "ham" applications, but certainly is of little or no value in the communications field. The majority of germanium devices are rated to 85°C, while the more expensive silicon units will operate at 175°C. Note that these figures are for Centigrade, not Fahrenheit!

Many interesting comments and questions have been received as a result of the initial Solid State Column in the December issue of Communications Horizons. Several of the more pertinent questions, which should be of interest to other readers, are reproduced.

For example, F. W., a serviceman in Miami, Florida, asks "What circuit can be used for a simple low noise preamplifier in conjunction with rather antique 160 mc. f.m. units?" The circuit shown in fig. 1, was designed by Motorola, Inc., for use with their new 2N1142 germanium epitaxil a mesa transistor. Although, the values and specifications are given for 200 mc., the unit can be retuned for equal or better performance on 160 mc. The amplifier has a bandwidth of 10 mc. on a center frequency of 200 mc. The power gain of this amplifier should be no less than 15 db and exhibit a noise figure of better than 5 db. The supply voltage (Vcc) is given as −6 volts d.c. and + Ie should be adjusted to produce a collector current of 4 ma. All coils are 3/16" inside diameter and are air wound.

Speaking of the Motorola 2N1142, this device is capable of developing 250 milliwatts output on 160 mc., as shown in fig. 2. This power amplifier, which could be used in vhf walkie-talkie applications, would be ideal as the final solid state stage in hybrid vehicular communications equipment. The circuit operates from a 14 volt supply and has a collector current rating of 40 ma., resulting in an overall efficiency of 40%. Very little driving power is required by this stage due to the 10 db. power gain.

J. W. of Culver City, California, inquires about a very low power f.m. signal source for experimental work in the 100-200 mc. range. Since he states that stability is relatively unimportant, the tunnel diode transmitter shown in fig. 3 need not be crystal controlled. This unit was described recently in the General Electric Company, Semiconductor Products "Newsletter". The transmitter section incorporates a 4.7 ma. General Electric axial lead tunnel diode modulated by a 2N188A general purpose PNP transistor. With the values shown, it will generate a signal in the 100-

LOW NOISE BROAD-BAND AMPLIFIER

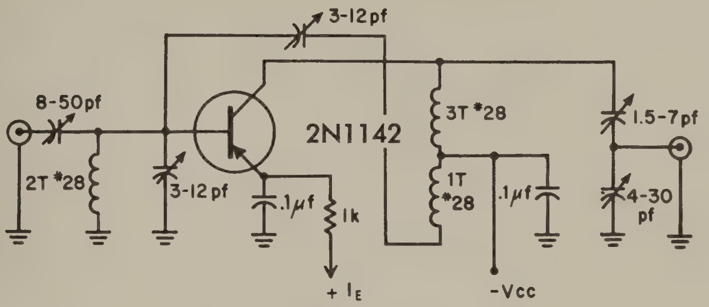


Fig. 1

160 MC POWER AMPLIFIER

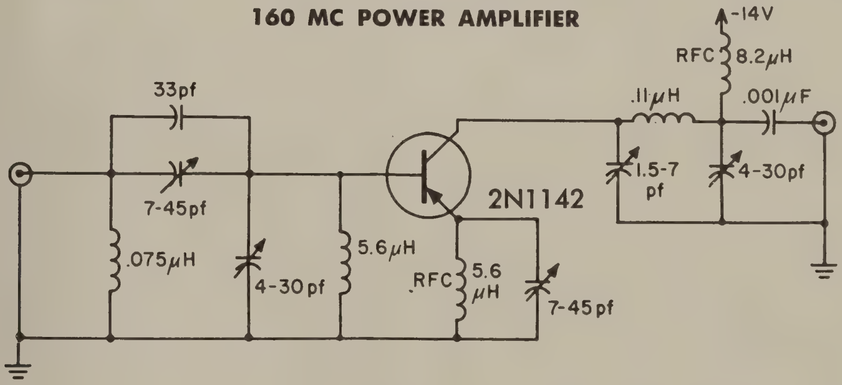
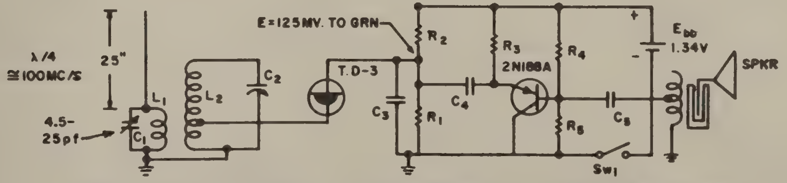


Fig. 2



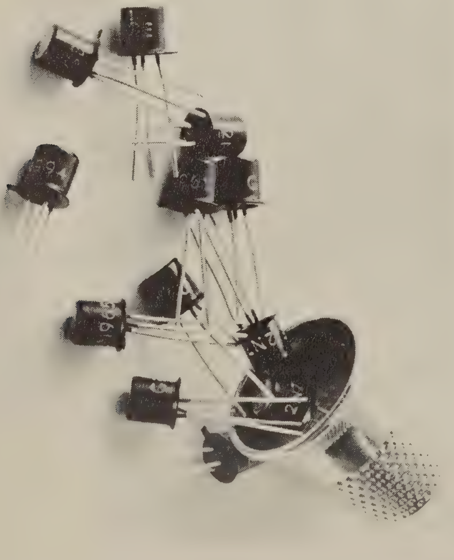
L_1 2 TURNS #16 COPPER 3/8"ID SPACED 1/8" FROM GROUND END OF L_2 (ADJUST FOR BEST STABILITY)
L_2 6 TURNS #16 COPPER 3/8"ID CLOSE-WOUND AND CONNECTED DIRECTLY TO C_2. TAPPED 1 TURN FROM GROUND.
C_1 4.5-25μμfd CERAMIC TRIMMER
C_2 1.5-5μμfd VARIABLE
C_3 800μμfd (VOLTAGE NOT IMPORTANT-SELECT FOR SMALL SIZE)
C_4 50μfd 6 VDC ELECTROLYTIC (VOLTAGE NOT IMPORTANT-SELECT FOR SMALL SIZE)
C_5 1μfd 35 VDC (VOLTAGE NOT IMPORTANT-SELECT FOR SMALL SIZE)
R_1 18Ω 1/2 W 5%
R_2 150Ω 1/2 W 5%
R_3 470Ω 1/4W
R_4 10KΩ 1/4W
R_5 10KΩ 1/4W

E_{bb} MALLORY RM-12R MERCURY CELL 1.34VDC-3600 MAH
Sw_1 NORMALLY OPEN SPST "PUSH-TO-TALK" SWITCH
SPKR 2" PM SPEAKER
T.D-3 AXIAL TUNNEL DIODE 4.7 MA.

Fig. 3

200mc band simply by retuning C1 and C2. Capacitor C2 determines the operating frequency primarily, while C1 controls the antenna loading. The two adjustments will interact, however. Because of the extremely low power involved (much less than 1 milliwatt) the range should be no greater than 200 yards, or so. The small audio voltage developed by the speaker (which is used as a microphone) is amplified by the 2N188A and is applied to the cathode of the tunnel diode oscillator. As a result of the junction capacitance dependance on anode-cathode voltage, the audio voltage produces a frequency modulation r.f. component. The ratio R1/R2 determines the operating point for the diode. Battery life, with the specified mercury cell, will be more than 300 hours of continuous operation.

B. M., another serviceman in San Diego, asks about low cost, low noise transistor types for r.f. amplifier service. In addition to the 2N1142 discussed earlier, there are several types of interest. For example, the Philco 2N1742 MADT type will exhibit a noise figure of less than 5 db at 160 mc. and costs less than $3.00 The newer Philco T2028 MADT was specifically developed for low noise r.f. amplifier service in communications applications and has a noise figure of 4 db at 200 mc. Again, this device sells for less than $3.00. The Texas Instruments new "Dalmesa" series should provide outstanding vhf performance at low cost. The new General Electric 2N994 diffused epitaxial mesa, although intended for switching service (a total switching time of 80 nanosec.) has a 1,000 mc. gain bandwidth product and should provide superb performance at vhf. These units sell for less than $4.00 in quantity.

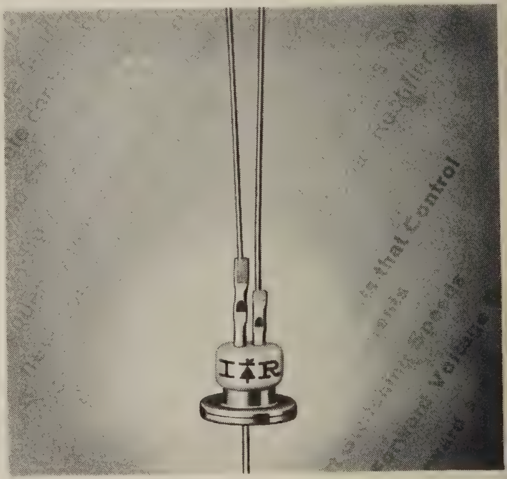


The New General Electric 2N994 should provide excellent performance in vhf communications equipment.

Whats New

Bendix Corporation, Semiconductor Division, Holmdel, N. J., have an interesting new line of three to 12 ampere silicon stud-type rectifiers designed to meet military specifications. Publication number RS18-27 provides additional data.

International Rectifier Corporation, El Segundo, California, have just announced a line of 1.1 ampere pigtail silicon controlled rectifiers (SCR) for use in inverters, power converters and motor control applications. For more detailed data, request bulletin SR-353-AX.



International Rectifier 1.1 ampere silicon controlled rectifier.

Rheem semiconductors, 350 Ellis Street, Mountain View, California, have introduced a universal silicon diode which is said to be an excellent replacement for nearly 400 silicon diode types. This device is priced at $1.15 in single quantities.

D.L.S.

DU PONT SAYS . . .

TEFLON IS NOT DANGEROUS

EDITOR'S NOTE: Page 20 of the November issue, Communication Horizons, carried a SY-PEP paper entitled "Danger TEFLON" This paper described *reported* dangers connected with the close association of the insulating material "Teflon" as collected by the author of the paper, Skip Yem, Palo Alto, California. Since this SY-PEP paper has appeared in print, considerable furor has been stirred up over the question "How dangerous actually is Teflon?" While Horizons Publications sought the answer to this question the E. I. Du Pont Company, Wilmington, Deleware, sought Communication Horizons. Subsequent exchanges of information between Du Pont and Horizons indicates that there is probably no *real* toxic danger to "Teflon" or its fumes under even the most severe conditions. The following is in the form of an answer to the Skip Yem article, from the E. I. Du Pont Company. Author Yem, incidentally, has graciously offered to withdraw his November paper from further SY-PEP consideration.

Harold G. Brown, Jr. writes for the E. I. Du Pont Company, "Teflon" flurocarbon resin, a unique plastic material manufactured by the Du Pont Company for the last 20 years, presents no health or safety hazards to the users of communications equipment containing this material. "Teflon" is being widely used in sockets, flanges, and insulating blocks in radio frequency gear because it can withstand temperatures up to and beyond 400 degrees C., because it has a very low dielectric constant, and because it does not absorb moisture.

"At temperatures reached in normal operation of radio equipment, or even under abnormal conditions, "Teflon"presents no hazard. The equipment itself would burn before the "Teflon began to break down and give off decomposition products. Even if the "Teflon" were to burn along with the equipment, it would not emit the lethal fumes alleged in the November article.

"In all our experiences as manufacturers of this product and in the cumulative experience of hundreds of our customers and thousands of end users over the years, there has never been a fatality or serious injury resulting from exposure to "Teflon".

"Many times in the past we have investigated just such an unsubstantiated rumor — — often coming from apparently reliable sources — — as appeared in your article. Each time we have found the rumor to be without the slightest basis in fact. Our own investigations have been augmented by independent studies by the Medical Departments of both the Air Force and the U. S. Navy. There is no case of a laboratory technician who became ill from smoking a cigarette contaminated with "Teflon" and later dieing, as your magazine reported.

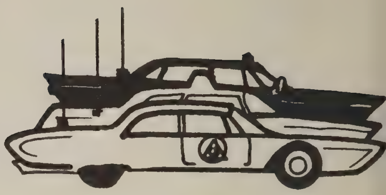
"What is true, and what may have contributed to the spread of the rumor is the fact that a man who directly inhales fumes given off when "Teflon" is heated to 700—800 degrees F., or who smokes a cigarette into which particles of "Teflon" gas has been introduced, could contract symptoms similar to those of old-fashioned grippe. This discomfort passes off after 24 to 36 hours, is non-cumulative, and leaves no after effects. Du Pont has carefully pointed this out to all users of "Teflon".

Du Pont does recommend the following for shops processing "Teflon".

"Any hazard is easily prevented by providing adequate ventilation around the machine (or bench on which "Teflon" is used) and by insuring that cigarettes are kept in closed areas.

Horizons Publications wishes to thank the E. I. Du Pont Company, Wilmington, Deleware, for clearing up this misunderstanding fermented by an apparently near-ageless rumor.

PUBLIC SAFETY COMMUNICATIONS



Material Prepared and Submitted by
ROBERT E. BROOKING
Communications Engineer
City of Burbank, California

"LAST UNIT . . . 10-9"

In the November issue of Communication Horizons, some of the problems caused by channel splitting were discussed. In the October issue of the APCO Bulletin, there appeared an article written by Al Shirk, Radio Engineer, Ohio State Highway Patrol. Al titled his article: "How Loud is 5 Kc?" He mentions the complaint, "My transmitter is not as strong as Joe's; check with his technician and try to make ours sound as loud." The complications of this reasoning by Department Heads or Chief Administrators who know nothing about the technical working of radio or the Rules and Regulations of the F.C.C. can be many. The most obvious, of course, is that the poor radio man is in the "doghouse" if he doesn't raise the modulation level and he faces an F.C.C. citation if he does. But why this sudden interest in loudness?

Al answers this too: "How loud is 5 Kc? In a test receiver, a signal with 15 Kc deviation, one Kc sine wave modulation was recorded at the audio amplifier; the deviation was reduced to 5 Kc and recorded. In this particular test, the difference was 10db." No wonder the boss is complaining. When he tries to increase the volume, he raises the noise by 10 db, and so, —darn that useless radio man.

Our radio man tries to explain that a new base station antenna might help, also some new equipment with modulation limiters in the transmitters and split-channel filters in the receivers. The boss can't understand this sort of nonsense, after all those radios aren't over six years old; bought them when we switched to 12 volt cars. Our radio man is prepared for this one and hands the boss the F.C.C. Order on Narrow Band Standards, adding that these must be met by November 1, 1963. The boss pushes the paper back adding that the new antenna will be O.K., price isn't bad and order the filters for the base receivers. Now about the cars, the Department is adding several new cars; write some specifications on these new radios and we will order enough for the new cars. Our radio man thanks the boss and leaves. He visualizes the solution. When the new radios arrive, the difference will be obvious and he will be off the "hook."

In due course, the radio equipment and the cars arrive. The radios are installed and the "boys in blue" rush for the new cars; but by the end of the week, the rush has reversed; the "boys" are ignoring the new cars like a plague. Meanwhile, the new filters have been installed in the base receivers. The reaction of the dispatchers is immediate. Joe's system, previously mentioned, shares the frequency; but now his transmissions instead of being louder just "break up". The same thing has been said about reception in the new cars. Our radio man isn't worried; let Joe pull his deviation down to 5 Kc instead of violating the Rules.

Then one crisp fall morning it happens; two men walk into the local bank and relieve the teller of a substantial sum of money. The alarm is given and over at Headquarters, various detectives and supervisory personnel rush from the building, jump into cars, turn on the radios and call the dispatcher. The idea is to block all escape routes but the only thing that happens is the dispatcher advises that the units

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Mail Before January 12 for Guaranteed Delivery of February issue!

are "breaking up." Some of them are new radios with heated crystals. Three minutes later these units begin to talk and hear but three minutes have been lost. Later that day the boss has some unkind words about radios – at least our old stuff worked. Our radio man leaves shaking his head, goes back to his desk and tries to reason why. An idea begins to take shape, a heated crystal isn't on frequency until heated to the specified temperature. No wonder the radios didn't work; those cars had been parked all night: Well, the solution to this one seems easy – just rewire the heater circuit so that it would be hot at all times. But what about the batteries? Oh me, how did we get in this mess anyway? Here we are looking at all the progress that has supposedly been made toward better communication. Instead we have less audio, more noise, more ignition interference, filters that chop up the signal and crystals that are off frequency for three minutes and those three minutes can be mighty important to a Police or Fire Department.

The old filters are put back in the base station receiver. The dispatchers are happy but the radio man isn't;– he is thinking about that .005% tolerance after November 1, 1963. Well, he could just wire the crystal heater circuit for continuous service and let the automotive maintenance crew worry about the batteries.

Shortly afterward, the audio level on Joe's base station suddenly does a nose dive. Some discreet inquiries reveal that some new mobile units have been added to Joe's system. It seems they didn't work until the manufacturers "rep" suggested cutting the deviation to 5 Kc. Our radio man feels better, the "heat" is off, he thinks.

Then the phone rings: "Please come up to the City Manager's Office, there is a letter here, something about a concurrence to use a frequency 30 Kc from our police frequency – whatever that means." Our radio man shudders; now he not only must worry about his own systems, but he must be an allocations engineer as well. "Let's see, how much power is this system going to use, what type antenna at what height and how far away? Wonder what the other cities on our police frequency will do? Guess I better tell the City Manager I'll have to study this before I can give him an answer. Then I can bring it up at the next APCO Chapter meeting. Guess I'll have to find time to get to the meeting; maybe I could clean up a few of those odd projects on a Saturday - darn - here it is almost Christmas and I promised the wife I would help with the Christmas shopping. Maybe I should have taken that factory job - at least I could go home at 5:00 p. m.

SPURIOUS SIGS

Sylvania Electric, Mountain View, Calif. are marketing tunable parametric amplifiers which feature a stable 20 db gain at 15 mc. bandwidth. The noise figure of the new amplifier is 3 db.

Working with varactor frequency multipliers? Microwave Associates, Burlington, Mass., have devices available which permit an output of 3 watts at 1120 mc. and all solid state!

SPECIALISTS IN SOLID STATE

- ★ Communications Equipment from DC to 1.2 Kmc.
- ★ R. F. Signal Sources - Microwatts to 100 watts
- ★ Prototypes, Conventional or Etched Circuitry
- ★ Coded Command Receivers for any Frequency
- ★ Single Sideband Receiving Equipment
- ★ Frequency Translators for FM, AM or SSB.

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OUR MAN IN WASHINGTON

Manager of Communication Horizons' Washington Office, Robert E. Tall, reports on the past month's communication activities

EDITOR'S NOTE:

Once again Mr. Tall's monthly report from Washington is pre-empted by an exceptionally newsworthy Report-in-Depth. Motorola President Robert W. Galvin, speaking before the 12th National Conference of the Institutt of Radio Engineers professional Group on Vehicular Communications in Minneapolis on November 30th, proposed a "fundamental change" in the entire FCC-IRAC allocations set-up. His speech, reproduced here, has attracted considerable comment among all users of the VHF-UHF spectrum.

"The ultimate purpose for a conference such as this is improved mobile radio communications.

"Our record in this regard is excellent. The cooperative and progressive attitude of user, service company, manufacturer and government agency has produced tremendous growth in the number of users, licenses and transmitters, the high density use of the spectrum assigned to us, and the variety and quality of uses of two-way radio.

"In our quest to achieve continuing improved communications, the industry and the users live with two general sets of conditions. The first is that set of conditions under our control — the technical, marketing, and economic aspects of our business. Competitive forces continue to assure that these are generally handled well.

"The other set of conditions is one step removed from our control. It relates to those government agency policies and decisions that determine the frequency spectrum available to our use and the rules associated with them. We are fortunate to have enjoyed the objective and enlightened interest of a Federal Communications Commission which has done everything reasonable to encourage mobile two-way communications in the past. But in order for the Commission to continue to assist us in full measure, the need for certain fundamental changes, and I emphasize fundamental changes, must be reasserted by the Commission, by Congress, and by ourselves starting soon.

"I would like to discuss three related topics regarding agency matters—spectrum management, TV allocations, and mobile assignments.

"Most observers of our nation's spectrum management agree that a redefinition of the roles of two spectrum referees is essential. The Federal Communications Commission and the Interdepartment of Radio Advisory Committee have made the best of a most difficult dual headed assignment.

"The problem of dual responsibility, is not one of people or individual agency organizations, but is rather the deficiency of a system as illustrated by these three factors.

"First, commercial users of the spectrum must go to a regulatory agency established by statute — The FCC — whose total job is the objective regulation of a part of the spectrum. In contrast, IRAC is both the user and a regulator. IRAC is not a statutorily established regulatory body but a committee of representatives from twelve government departments or agencies who use radio frequency energy. This committee can request and even assume control over virtually any part of the sptctrum which will reasonably serve our national interests and divide the use of that part of the spectrum among itself.

"In any proceeding where there is any consideration of the return of any of the spectrum from government to FCC control, any single agency can veto and prevent such action. With increasing demands being made on the spectrum by expanded or new uses, we can no longer afford the luxury of a government committee of users, whose authority has grown by tradition rather than statute, self-licensing itself and unilaterally holding or withdrawing major portions of the radio spectrum from general citizens' access.

"Second, the FCC is no longer a coequal administrator of the spectrum. It neither enjoys the proportion of the spectrum under its control nor does it have any veto over IRAC's absorption of additional bands. Whereas ten years ago the Federal Communications Commission was the principal spectrum authority, IRAC now controls some seventy percent of the spectrum — forty percent on a strictly exclusive basis — and the FCC only manages thirty percent of the spectrum from twenty-five megacycles to 10,500 megacycles.

"Third, it is wrong to operate on a principle of simply dividing the radio spectrum. It is possible to share a greater proportion of the spectrum than is currently being shared between users.

"The Federal Communications Commission has frequently demonstrated its encouragement of this principle, a most recent example being the proposal by certain commissioners and staff members for the sharing of certain unused television channels with mobile radio services. There are also many opportunities for sharing between military and commercial services based on such standard criteria as time and geographic sharing. We must have a machinery for deciding the merit of conflicting requirements, for determining the practicabilities of sharing to review the efficiency of frequency use.

"It is my understanding that the President is working with FCC Chairman Newton N. Minow and Dr. Jerome B. Wiesner, special scientific advisor to President Kennedy, making some attempt to resolve this problem by Presidential order. Whatever they might do, it should be affirmed or revised by legislative action.

"The defects of our system cannot be overcome by a simple executive order and the rearrangement of supervisory machinery.

"Legislation should be enacted which would broaden the powers of the FCC so that it could become the total and final arbitor of the spectrum. Among other things, this would require that the Commission be provided with adequate access to information on military uses, mechanisms for adequate security clearances, etc.

"But if this approach proves to be politically impossible, then a super spectrum agency should be established by law which would have the authority to arbitrate and decide between the FCC which would continue to serve the commercial licenses and IRAC which would represent government user interest.

"My second topic — related to the first — is television allocation. A fundamental spectrum management decision must be made regarding the 492 megacycles reserved for television's eighty-two channels.

"Almost a decade and a half of experience shows inefficient use of the UHF band because of a disparity of propagation characteristics. This in spite of an existing demand for more television stations. The television allocation is at one time both too large and too small. An important key to a broader national television service and to the freeing of frequencies for growth in other services is the establishment of a new standard of a lesser number of television channels, all in a contiguous band.

"Two proposals stand out as the type more likely to answer the most spectrum and service requirements. The first would start the television allocation with channel 7 or 175 megacycles and allow for thirty channels from that point upward. Certain important military services would have to be moved.

"This brings us to my third related topic; Mobile Radio Frequency Assignments. In addition to the special needs of MCC's, independent telephone companies, etc., two particular needs should be anticipated. (1) Private mobile radio service. (2) Common carrier radio – telephone service.

"Private mobile radio's needs and justifications are too well known here to require elaboration. Suffice to say that it must be given immediate and priority relief via such techniques as sharing mentioned earlier. Private mobile must be assured soon that it will be granted some forty additional megacycles to render the services to be demanded of it in the future. These assignments should be granted from the VHF band and/or as close to present assignments as practical.

"The common carrier radio telephone plan has been suggested as a broadband service. It, too, will require a sizeable assignment–something like fifty megacycles of band width or that order of size. In planning for this service–a new service–application of fundamental principles is essential. The nature and degree of current spectrum problems should not be compounded by the establishment of this new service on some expedient basis.

"The Commission must force basic answers on topics one and two and only then make the full allocation and prepare for the institution of these new broadband services. Sufficient bandwidth should be available in the 800 megacycle region with the reduction of UHF television assignments. Field tests have proven that this band has more than adequate propagation characteristics and coupled with proper systems techniques would permit excellent city, town and key highway service.

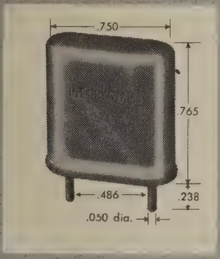
"At these frequencies, many believe that thirty channels would be more than sufficient for national coverage of commercial and educational television. That number of channels or a number of similar size would free some 300 megacycles. The Commission has made a serious review of such a proposal but the apparent costs and dislocations to the military were sufficient to be a deterrent to change. Because some service and costs are to be effected by the fundamental change that is required to solve our problems, I hope there is still an opportunity for the reactivation of this type of plan.

"As a second choice television should be moved to UHF but in all probability would not need the entire UHF band. As a rule of thumb, at these frequencies something like twice as many channels as the first plan may be required to make up for propagation characteristics, system requirements, etc.

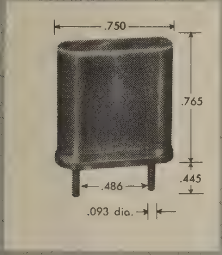
"Our spectrum is finite but our use of it, dynamic because of scientific advance and economic growth. This requires that we be prepared to change our allocations, assignments, and rules governing them from time-to-time. This is one of those times. This is one of those big times. Big change is required–change based on long term predictable requirements and basic fundamental principles. There is no simple, universally popular solution unfortunately. But one thing is sure, the continuation of the status quo or resorting only to piecemeal solutions will in the long run aggravate the problem and effect the most unpopular condition.

"As it has in the past, the Commission must be encouraged to take a firm, fundamental stand on these topics. If it does, I am confident sound judgments will result and our ultimate purpose of improving mobile communications will continue to be assured.

Custom made CRYSTALS



F-605



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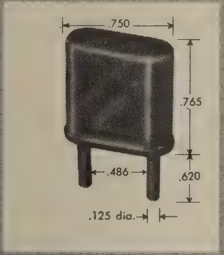

F-612

FREQUENCIES 70 KC TO 137 MC

DESCRIPTION AND DATA:

All of these crystals are of the plated, wire-mounted type. Low drift AT-cut blanks are used in these units above 500 KC, and low drift DT and CT-cut blanks are used in units below 500 KC; any crystal can be supplied for operation with or without an oven.

TEMPERATURE TOLERANCE:
AT—±.005% from —55° to +90°C.
±.002% from —30° to +60°C.
DT-CT—±.01% from —40° to +70°C.

CALIBRATION TOLERANCE:
Supplied to meet equipment manufacturers speifications and may be as close as .001% without oven or .0005% with oven. Where no equipment is specified the following will apply.
AT— .0025% of nominal at +30°C.
DT-CT— .01% of nominal at +30°C.

DRIVE LEVELS:
Maximum, AT—
10 milliwatts 500 KC to 999 KC
4 milliwatts 10,000 KC to 24,000 KC
2 milliwatts 25 MC to 137 MC
DT-CT—2 milliwatts

CIRCUIT: As specified by customer. Crystals are available for all major two-way equipment and in most cases the necessary correlation data is on file. Where circuit is not specified, the crystal will be calibrated for operation into a load capacitance of 32 mmf.

FREQUENCY RANGES AND MODES OF OPERATION

200-500 KC:
Operates on fundamental edge shear oscillation. Load capacitance 32 mmf . . . or as specified by customer. If load is not known specify circuit or equipment in which crystal will be used.

500-20,000 KC:
Operates on fundamental face shear oscillation. Load capacitance 32 mmf . . . or as specified by customer.

10-60 MC:
Operates on third mechanical overtone at anti-resonance. Will give reasonable output in tuned circuit.

60-100 MC:
Operates on fifth (or seventh) mechanical overtone at series-resonance. Drive level must be kept below 2 milliwatts.

ONE DAY SERVICE

Orders for less than five crystals are shipped within one working day following receipt of order (except low frequency and special crystals which require 10 to 30 days for processing). Orders received on Mon. thru Thurs. will be shipped the day following. Orders received on Fri. will be shipped the following Mon. Postage is prepaid within continental U.S. when cash accompanies order. All others are shipped F.O.B. Oklahoma City.

SUPPLY THIS INFORMATION WHEN ORDERING

MOTOROLA: Crystals can only be properly correlated for Motorola equipment if the crystal type number is given. Example: D02, R28, D03, etc. In cases where crystals are required for type D-14, 800 and 801 holders, always specify crystal frequency or the high IF frequency. Check whether the crystals are to be used in ovens.

GENERAL ELECTRIC: Specify model number of transmitter and receiver RF Decks. Example: 4ES13A3, 4ER24B1, 4ET5B3, etc. When ordering crystals for 450 MC equipment specify:

Receiver Crystals:
A. If they are heated or non-heated.
B. If the unit is AFC or NON-AFC Controlled.
C. Platter number of present receiver deck.

Transmitter Crystals:
A. If they are heated or non-heated.

R.C.A.: Specify model number of unit or MI Number of the crystal. Always indicate whether crystals are to be non-heated or heated type.

OTHERS: Specify model number of the receiver and transmitter as well as any formulae that pertain to the correct crystal calculation.

PRICES — F-605, F-609, F-612 CRYSTALS

Fundamental KC		**Fundamental KC**		**Overtone MC**	
200 - 499*	**$12.50**	3000 - 3999	**$5.75**	10 - 34.99	**$ 6.50**
500 - 849*	**15.00**	4000 - 5999	**5.00**	35 - 44.99	**7.00**
850 - 899*	**13.50**	6000 - 9499	**4.50**	45 - 60	**8.50**
900 - 999*	**12.50**	9500 - 10999	**5.00**	61 - 75	**10.50**
1000 - 1499†	**9.80**	11000 - 14999	**6.30**	76 - 137	**15.00**
1500 - 1999†	**7.50**	15000 - 20000	**8.00**		
2000 - 2999	**6.50**				

*Allow 10 to 30 days for processing. †Allow 2 to 3 days for processing.

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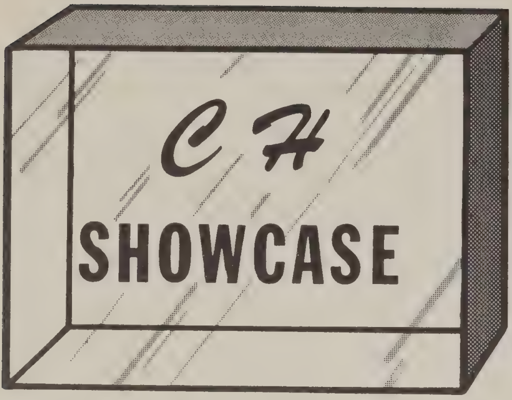


NEW PRODUCTS IN THE PROFESSIONAL COMMUNICATIONS FIELD

RCA, Inc. has begun shipment of the new "efficiency line" of compact, two-way mobile radio equipment for business communications in the "uncrowded" UHF 450 megacycle band.

Manufactured at the RCA Telecommunications Center in Meadow Lands, several advantages of UHF operation at a cost "nearly comparable" to existing VHF equipment.

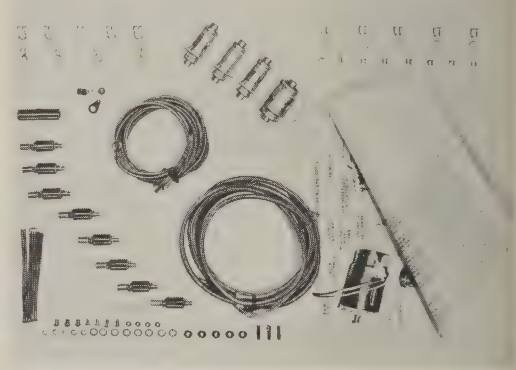
The new equipment was field tested in the metro Chicago area and according to RCA, passed every test with flying colors'.

The new mobile equipment line is being supplied in a frequency range of 450-470 mc. with a 15 watt power. The unit is available in either 12 volt d.c. operation only, or 6 and 12 volt d.c.. operation.

The new equipment incorporates a standby feature whereby the radio can be placed in a "receive only" position thereby cutting off even the transmitter filaments in the interest of power consumption. A number of RCA accessories are available.

Checker Electronics, Inc., Grayslake, Illinois, has announced the "Defender" monitor-receiver designed especially for the Safety Radio services. The crystal controlled dual conversion superhetrodyne FM receiver is available in the 30-50 and 150-175 mc. regions. Power drain is 35 watts, with a self contained speaker. One channel is provided with the standard unit, two are available per monitor on order. Sensitivity is less than 0.5 microvolts for 20 db quieting.

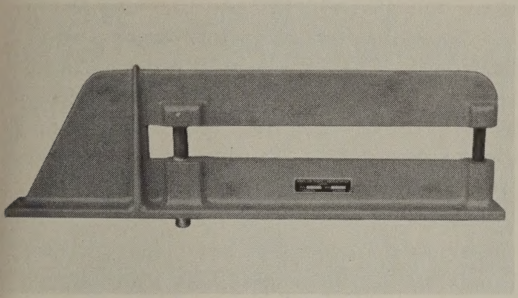
The E. F. Johnson Company, Waseca, Minnesota, is now offering a complete ignition suppression kit for the suppression of ignition noise on motor equipped vehicles. The kit includes an illustrated booklet with detailed instructions and all necessary hardware and fittings for complete installation by the professional service man.



New E. F. Johnson Noise Suppression Kit

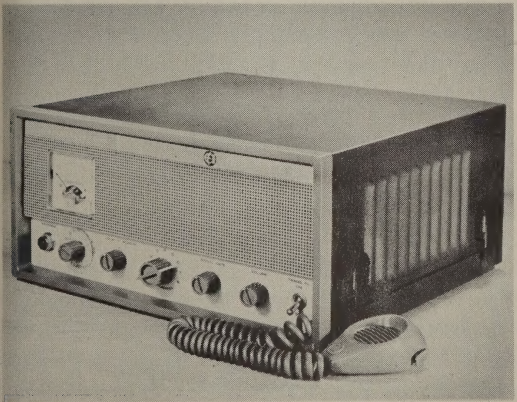
The Johnson kit supplies effective noise suppression by shielding the wires carrying noise signals, by a resistor-condensor combination on the generator and distributor to suppress arcs. In the spark plug circuitry shielded cable is used extensively and resistors are inserted to block the transfer of RF energy back to the car wiring. Catalog No. 250-801 Johnson Automotive Suppression Kit is available at $13.50 net through authorized E. F. Johnson Company distributors or dealers.

Sinclair Radio Labs, Dept. CH, 260 Deleware Avenue, Buffalo, New York recently announced a new low silhouette, low clearance two-way antenna for railroad locomotives. The unit is designed for a frequency range of 152-174 megacycles at a power rating of 200 watts. Fabricated completely from non-rusting, light weight anodized aluminum, the Model 221A Train Antenna measures but 6¾ inches high and can be mounted on any reasonably flat metal surface with the stainless steel mounting bolts provided. Uniform reception-transmission is assured at all speeds because the "sway" of normal whip antennas is eliminated. The manufacturer will supply the unique antenna to the customers' color specifications at no additional cost.



Sinclair Labs Novel High Speed Antenna

Apelco, 213 East Grand Avenue, South San Francisco, California, will show three brand new high power, marine radiotelephones and a dual scale depth sounder at 1962 boat shows. The new ship-to-ship and ship-to-shore units incorporate heavy duty features for party boat, fish boat and general commercial use as well. The three units, AE-65M (67 watts), AE-95M (100 watts) and AE-130M (135 watts) are packaged in flat-pack cabinets. Choice of mounting on bulkhead, overhead or table top will be available. Chassis parts, components and cabinets are treated against the usual moisture problems of the sea. Eight crystal controlled two-way channels plus tuneable broadcast band will be offered in each of the new Apelco units. Each is available for 12, 32, or 110 volts DC, 115 VAC operation. Remote control for any of the units is available. The AE-65M and AE-130M cover 2-10 mc/s, while the AE-95M covers 2-5 mc/s.

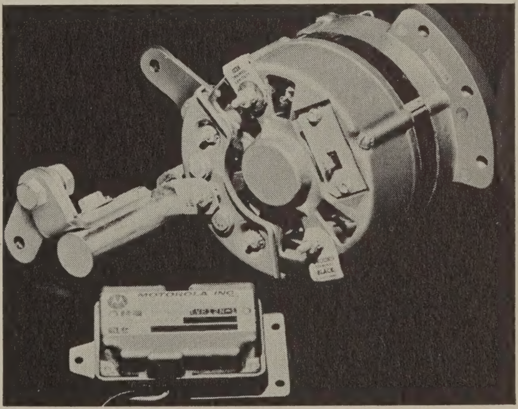


New Apelco Marine Series

RCA has announced three new beam power tubes representing major improvements in radio frequency power generation for mobile equipment. The new r. f. power amplifiers will satisfy mobile power requirements up to 500 mc/s, and provide three methods of cooling. Designated the RCA-8072, RCA-8121 and RCA 8122, the tubes are rated for continuous wave or linear service. The trio of tubes, all ceramic-metal construction, have the following ICAS ratings:

8072	700 volts on plate	CW power of 110 watts at 50 mc/s; 105 watts at 175 mc/s; 85 watts at 470 mc/s.
8121	1500 volts on plate	CW power of 235 watts to 500 mc/s.
8122	2000 volts on plate	CW power of 300 watts at 500 mc/s.

Motorola Car Radio Sales Division will soon offer its new all-electronic alternator system to U. S. car owners as replacement equipment in their autos. The alternator system replaces the dc generator and its regulator, and is designed to last the life of the car. The unit, which consists of an alternator, voltage regulator, and universal installation kit, will be marketed as a complete package by Motorola distributors, and by distributor — jobbers of automotive equipment. The unit comes in two current capacity models, 30 or 45 amps, fitting most negative ground vehicles built since 1959.



PEOPLE, PLACES *and things*

A review of recent personnel appointments, contracts, and factory locations

Communications Company (COMCO) of Coral Gables (Miami), Florida has completed an expansion program of the entire factory which more than triples the floor space and at least quadruples the output capacity by an addition of 20,000 square feet to the original building of approximately 10,000 square feet. The new buildings include a two story, 82 x 120 foot, factory; one-story 2500 square foot machine shop; and two-story office building, 3600 square feet. COMCO specializes in the design and manufacture of two-way VHF FM land mobile communications systems.

New Comco Quarters

Alfred G. Holtum, Jr. has been appointed Chief of the newly formed government research and development group at *Andrew Corporation*, according to John S. Brown, Director of Engineering. Mr. Holtum was formerly chief engineer of the company's California operations, specializing in telemetery antenna systems. A graduate of New York University and Rutgers (M.S.E.E. degree), he is a senior member of the IRE.

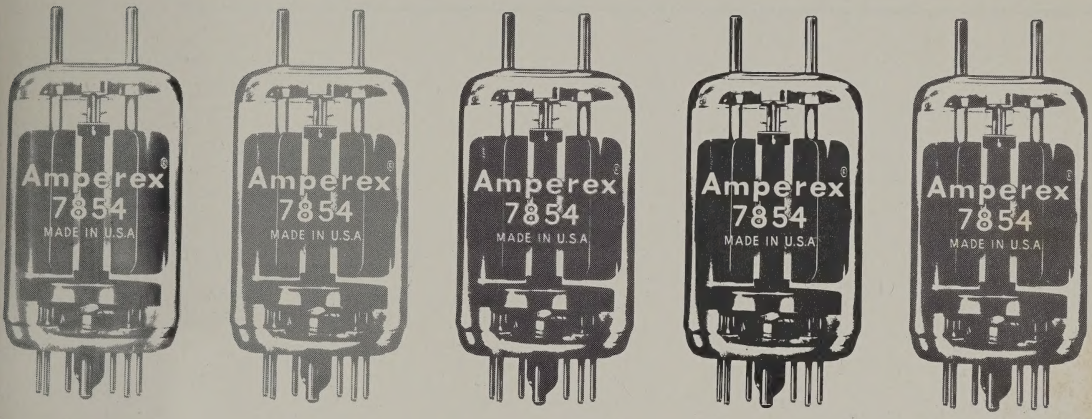
John Altamayer, General Manager of *New-Tronics Division* of *Automatic* Radio Corporation, announces the appointment of Mr. Alvin A. Berman as Distributor Sales Manager. Mr. Berman is well known to the industry, having served with Tung-Sol for 38 years. The appointment of Mr. Berman was necessitated by the expansion of the New-Tronics line of communication antennas, as well as the growing list of distributors.

William DeZonia has been named manager of Mobile Telephone Sales and Product Planning at *General Electric's Communication Products Department* in Lynchburg, Virginia. DeZonia will head an expanded mobile telephone sales organization responsible for the company's full simultaneous duplex mobile dial car telephone equipment and for other MTS products. DeZonia was previously district two-way radio sales manager for GE in Dallas.

James E. Pitman has been named manager of Marketing Research and Planning for the *General Electric Communication Products Department*, Lynchburg, Virginia. Previously manager of product planning for point-to-point communication, Pitman will now be responsible for Marketing Research on all product lines made by the department. Pitman is a 1949 graduate of Harvard.

William G. Chaney has been appointed manager of Mobile Telephone Systems engineering and Personal Communications engineering for *General Electric's Communication Products Department*, Lynchburg, Virginia. In his new position, Chaney will be in charge of engineering for G-E's simultaneous duplex mobile dial telephone units and other MTS products.

Amperex® announces a new twin-tetrode...type 7854...



for special mobile VHF/UHF transmitter applications which require 50% greater plate dissipation than the renowned Amperex 5894

With exceptional reliability assured by unique ratings for both heat sink and forced-air operation, the new Amperex 7854 is applicable for either mobile or base station applications.

The 7854 is designed to assure unrivalled performance as an RF power amplifier, oscillator, modulator and frequency multiplier in land-based and airborne VHF and UHF transmitting equipment — for amateur, professional, military and police.

Typical Operation — Class C Push-Pull RF Power Amplifier and Oscillator

	FORCED AIR ICAS	HEAT SINK ICAS
D.C. Plate Voltage	1000 volts	750 volts
D.C. Grid No. 2 Voltage	262 volts	260 volts
D.C. Grid No. 1 Voltage		
Fixed or from common resistor of	2x30 K ohms	2x30 K ohms
D.C. Plate Current	2x120 ma	2x120 ma
D.C. Grid No. 1 Current	5.7 ma	5.5 ma
Driving Power	3.5 watts	3.5 watts
Power Output	163 watts	123 watts
Frequency	175 Mc	175 Mc

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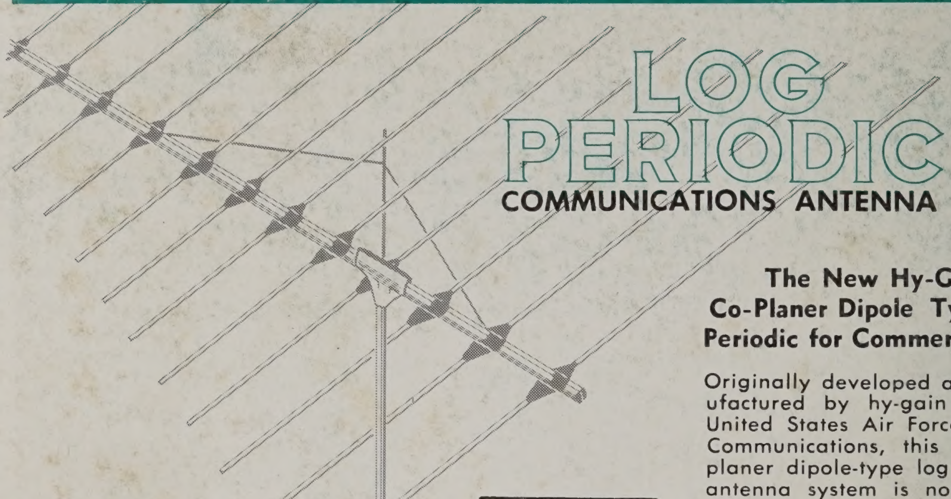

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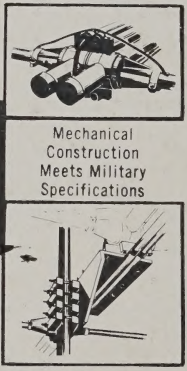


Mechanical Construction Meets Military Specifications

The New Hy-Gain Co-Planer Dipole Type Log Periodic for Commercial Use

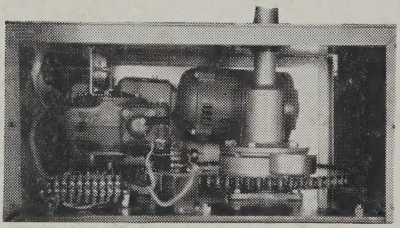
Originally developed and manufactured by hy-gain for the United States Air Force Global Communications, this new co-planer dipole-type log periodic antenna system is now available for commercial applications.

VSWR is less than 1.5-1 Average Front-to-Back Ratio 20 db. Forward Gain averages 8.7 db over isotropic source.

Specifications:

Operates without hiatus over frequency spectrum . . . Power handling capabilities 2.5 KW AM, 5 KW P.E.P. Mechanical construction meets military specifications.

FINEST HEAVY DUTY ROTATING SYSTEM



HEAVY DUTY ROTATOR

New Hy-Gain rotating system is designed for commercial duty. It will rotate and hold the largest directional communications arrays. Rotator delivers 5,000 inch pounds of rotating torque and 20,000 inch pounds of braking torque. Turns at 1 RPM. Direction indicator is selsyn controlled and is accurate plus or minus 5 degrees. Integrated control and direction indication unit supplied. Operates on 110 volts A.C. 60 cycle 3 amps. Fully weather protected inside and out. Housed in aluminum enclosure.

$595.00

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